

extends farther laterally revealing less of the mastoid portion of the auditory bulla, and the skull is generally more angular with better developed processes and ridges marking areas of muscle attachment.

Compared with 5 topotypes and the type of *Thomomys bottae toltecus*, *T. b. connectens* is slightly lighter colored, has much longer hind feet (on dry skins, adult males measure 33 mm. as against 29 mm.) and is constantly larger in every part measured, except for the mastoid breadth and extension of the premaxillae posteriorly to the nasals. In the two parts of the skull indicated there is a slight overlap in measurements. Relative to the basilar length each of the five adult males of *connectens* has longer nasals and rostrum, broader rostrum and a lesser width across the zygomatic arches than has either of the two adult males of *toltecus*. In *connectens* the length of the rostrum amounts to more, rather than less, than 67 percent of the zygomatic breadth. Also, in *connectens* the hamulus of each lacrimal bone is as large again and the inferior margin of the anterior opening of the infraorbital canal is continued anteriorly as a distinct ridge rather than curved upward to form part of an ellipse. Measurements, for the most part not previously available, for *toltecus* are offered above as facilitating comparison with related races.

Remarks.—Among named subspecies of *T. b. bottae* whose ranges approach nearest to that of *connectens*, probably greatest similarity is shown to *T. b. aureus*. The range of *connectens*, as known to me, however, is separated from that of *aureus* by a large area from which no specimens have been examined though the species *T. bottae* doubtless occurs in suitable environments there. The northwestern limits of range of *connectens*, then, remain to be determined. Specimens from Socorro are variously intermediate in color and to a certain extent in external measurements between *connectens* and *opulentus* but cranially they agree well with the latter.

Specimens examined.—Total number, 19 as follows: Type locality, 14; 4.5 miles south Albuquerque, 4,943 feet elevation, Bernalillo County, New Mexico, 4.

ZOOLOGY.—*A note on Dictyocaulus from domestic and wild ruminants.*¹ G. DIKMANS, Zoological Division, Bureau of Animal Industry. (Communicated by MAURICE C. HALL.)

Chapin (1925) described as *Dictyocaulus hadweni* n. sp. a nematode collected from the lungs of the American bison, *Bison bison*, at Wainright, Alberta, Canada, by Dr. Seymour Hadwen. Following the description, Chapin devoted a short paragraph to a comparison of *D. hadweni* with *D. filaria*, and differentiated *D. hadweni* from *D. filaria* by the more abrupt termination of the dorsal rays, the complete fusion of the medio-lateral and postero-lateral rays, and the longer spicules. Apparently the use of the name *Dictyocaulus filaria* should be considered as a *lapsus calami* for *Dictyocaulus viviparus*, or else Chapin really intended to compare *D. hadweni* with *D. filaria*. *D.*

¹ Received March 17, 1936.

hadweni resembles *D. viviparus* in the characters mentioned by the author and there would, therefore, have been some reason for attempting to differentiate between them, but *D. filaria* differs so markedly from *D. hadweni* in the conformation and size of the spicules alone that comparisons on any points other than spicules would be the only ones in order. Chapin stated that *D. hadweni* differs from *D. filaria* "in the longer spicules," and from this statement the reader would infer that the spicules of *D. hadweni* are longer than those of *D. filaria* whereas, as a matter of fact, the spicules of *D. hadweni* are shorter than those of *D. filaria*. Since this fact could not have escaped



FIG. 1.—Dorsal rays of bursa of *Dictyocaulus viviparus* showing (1-6), variations in position and, (7-13), variations in termination.

Chapin's attention if he had made a comparative study of these two nematodes, it might be inferred that the use of the name *D. filaria* was actually a *lapsus calami*. However, this inference also meets with difficulties because had the author intended to compare *D. hadweni* with *D. viviparus* and had he made a comparative study of these two forms he would have noted their similarity in the very points on which he attempted to differentiate them, viz., the fusion of the medio-lateral and postero-lateral rays, the position and termination of the dorsal rays, and the conformation of the spicules, the spicules of *D. hadweni* differing from the spicules of *D. viviparus* in size only.

For some time the writer has been making all identifications of lungworms from domestic and wild ruminants as these have been referred to the Zoological Division for determination, and during that time considerable difficulty has been experienced in differentiating *D.*

hadweni from *D. viviparus* on any valid morphological grounds. Dr. W. E. Swales of the Institute of Parasitology, McDonald College, Quebec, Canada, under a coöperative agreement for exchange of specimens in various parasite groups, has referred specimens of *Dictyocaulus* collected from cattle and various wild ruminants in Canada to the Zoological Division of the Bureau of Animal Industry for study.

Since the females of species of *Dictyocaulus* are, for all practical purposes, indistinguishable, the writer has based his study of the members of the genus occurring in ruminants in North America on a comparison of male specimens, with special reference to the character and relative position of the rays of the bursa, the termination of the dorsal rays, and the size and morphology of the spicules. These studies give the following results: The ventro-ventral ray is always shorter than the latero-ventral ray, but there is no fixed ratio between the lengths of these 2 rays, and their relative lengths cannot be considered as a diagnostic character; the externo-lateral ray is always single and in position is widely separated from both the latero-ventral and the fused medio-lateral and postero-lateral rays; the externo-dorsal ray is single and somewhat shorter than the rays on either side of it; the dorsal rays are doubled, their positions and terminations vary considerably (fig. 1), and no specific value can be attached to either their position or their termination. The conformation of the spicules of *Dictyocaulus* from cattle, *D. viviparus*, is similar to that of the spicules of available specimens of *Dictyocaulus* from wild ruminants. In general the spicules of *Dictyocaulus* from wild ruminants are somewhat longer than the spicules of *D. viviparus* from cattle, but there is considerable overlapping (table 1).

So far as the females of *D. hadweni* and *D. viviparus* are concerned there are no definite morphological characters on which they can be separated from each other. It appears, therefore, that *D. hadweni* cannot be separated from *D. viviparus* on any valid, morphological grounds and, since *D. viviparus* is the older name, *D. hadweni* must fall into synonymy so far as its morphology is concerned. Only carefully controlled feeding experiments could establish whether we are dealing with biological varieties capable of infecting only cattle or only deer or whether these nematodes are biologically as well as morphologically identical.

Hsü (1935) described as *Dictyocaulus khawi* a nematode stated to have been collected from the lungs of swine in Tonkin, French Indo-China. The only point in which this nematode is said to differ from

D. viviparus is that one of the 3 digitations of the dorsal ray has an externo-lateral position. In view of the fact that the terminations of the dorsal rays may be extremely variable in position and appearance (fig. 1) this minor difference does not appear to be sufficient for the creation of a new species. On morphological grounds, therefore, *Dictyocaulus khawi* would also be considered as a synonym of *Dictyocaulus viviparus*, but in view of the fact that over most of the world *Dictyocaulus* is not found in pigs in spite of evident opportunities for

TABLE 1.—LENGTH OF SPICULES OF DICTYOCAULUS VIVIPARUS COLLECTED FROM DIFFERENT HOSTS

Hosts	No. of male specimens examined	Minimum length of spicules in microns	Maximum length of spicules in microns
Cattle <i>Bos taurus</i>	29	220	255
American bison <i>Bison bison</i>	14	220	295
Moose <i>Alces americana</i>	1	255	255
Elk <i>Cervus canadensis</i>	10	255	325
Reindeer <i>Rangifer tarandus</i>	12	220	315
Black-tailed deer <i>Odocoileus columbianus</i>	3	235	300
White-tailed deer <i>Odocoileus virginianus</i>	4	176	220
Mule deer <i>Odocoileus hemionus</i>	3	220	220
Red deer, probably <i>Cervus canadensis</i>	4	255	295

infection from cattle, there is the possibility that under special conditions existing in French Indo-China a strain of *D. viviparus* has become adapted to swine, as *Necator americanus* of man appears to have become adapted to swine in the West Indies, with the development of a new biological species which may show, as does *N. suillus*, certain fixed morphological characters, however slight, differentiating it from the parent species. Since Hsü did not collect the specimens which he describes there is, of course, also the possibility of error in labelling to be considered.

Skrjabin (1931) described as *Dictyocaulus eckerti* a worm found in the lungs of reindeer in the U.S.S.R. He stated that this worm differs from *D. viviparus* as follows: *a*, In the presence of cervical papillae

(these are not mentioned in the part of the paper describing the nematode); *b*, in the presence of a mouth capsule; *c*, in the length of the spicules; *d*, in the structure of the terminal portion of the dorsal ray. The length of the spicules is given as 290 to 310 μ and the figures accompanying the description show that they are morphologically similar to the spicules found in *D. viviparus*. The figure of the bursa of *D. eckerti* shows that the termination of the dorsal rays is similar to that of *D. viviparus*. With reference to the presence of a mouth capsule, the presence of a small, shallow, mouth capsule is a character of the genus and an examination of a number of specimens of *D. viviparus* collected from cattle at Bethesda, Md., shows that this character is present in *D. viviparus* from cattle as well as in *D. eckerti* from reindeer in the U.S.S.R. With reference to the presence of cervical papillae in *D. eckerti*, there appears to be no other record of the presence of these structures in members of the genus *Dictyocaulus*, and a careful examination of a number of specimens from both cattle and reindeer failed to reveal their presence. No information is furnished as to the appearance and location of the cervical papillae in *D. eckerti*. From Skrjabin's description and from the figures accompanying it, it appears that the lungworm collected from reindeer in the U.S.S.R. does not differ materially from *Dictyocaulus* collected from the lungs of reindeer in Alaska, aside from the rather surprising occurrence of cervical papillae in the former, and aside from this one item *D. eckerti* appears to be identical with *D. viviparus*.

DICTYOCAULUS VIVIPARUS (Bloch, 1782) Railliet and Henry, 1907

Synonyms.—*Gordius viviparus* Bloch, 1782; *Ascaris vituli* Bruguière, 1791; *Strongylus vitulorum* Rudolphi, 1809; *Strongylus micrurus* Mehlis, 1831; *Dictyocaulus hadweni* Chapin, 1925; (?) *Dictyocaulus eckerti* Skrjabin, 1931; (?) *Dictyocaulus khawi* Hsü, 1935.

Hosts.—Cattle, *Bos taurus*; American bison *Bison bison*; Moose, *Alces americana*; Elk, *Cervus canadensis*; Reindeer, *Rangifer tarandus*; Black-tailed deer, *Odocoileus columbianus*; white-tailed deer, *Odocoileus virginianus*; Mule deer, *Odocoileus hemionus*; Red deer, probably *Cervus canadensis*; (?) Swine, *Sus scrofa domestica*.

DICTYOCAULUS FILARIA (Rudolphi, 1809) Railliet and Henry, 1907

Dictyocaulus filaria is the common lungworm of sheep in North America, and has been collected also from the black-tailed deer, *Odocoileus columbianus*, and from the white-tailed deer, *Odocoileus virginianus*. In 24 male specimens from both deer and sheep, the length of the spicules varied from 330 to 580 μ , spicules 330 μ long and 580 μ long each being found once and the lengths of all other spicules varying from 365 to 515 μ . The ventro-ventral ray was found to be shorter than the latero-ventral ray in all the specimens

examined. The dorsal rays terminate in 3 processes but the position of these processes varies to such an extent that no diagnostic significance can be attached to it.

Bhalerao (1932) described as *Dictyocaulus unequalis* a nematode collected from the large bronchi of a Tibetan sheep. He stated that this nematode differs from *Dictyocaulus filaria* in having shorter spicules, only one male 28 mm long, with spicules 280 to 290 μ long, being available for examination, and also in that the ventro-ventral ray of the bursa was shorter than the latero-ventral ray, and he gave the specific name *unequalis* because of this inequality of the ventral rays. Since the ventro-ventral ray in *Dictyocaulus* is usually shorter than the latero-ventral ray, this supposed difference between *D. filaria* and *D. unequalis* disappears and, in the absence of any noticeable morphological difference, the difference of 40 to 50 microns in length in spicules based on the examination of a single specimen does not appear to be sufficient reason for the making of a new species when an otherwise identical species has a range of 250 microns. *Dictyocaulus unequalis* is, therefore, considered as probably a synonym of *D. filaria*.

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BOTANY.—*Eriogonum intrafractum*, a new species and new subgenus from Death Valley, California.¹ FREDERICK V. COVILLE AND C. V. MORTON, U. S. National Museum.

In the spring of 1932 the senior author and Mr. M. French Gilman, while studying the flora of Death Valley, California, under the auspices of the National Geographic Society, found a peculiar-looking perennial species of *Eriogonum*, which because of its immaturity remained unnamed. The plants were found in Titus Canyon, Grapevine Mountains, six miles below Leadfield, at an altitude of about 2,000 feet, growing in the crevices of a blue limestone ledge sloping to the north. The dead stems of the preceding year were about three feet high. Mr. Gilman revisited the locality and obtained additional specimens in 1934. These also were immature, and it was not until October, 1935, that Mr. Gilman was able to obtain good material,

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